
Hardware maintenance tools

There are fault indicators and hardware features that help you perform maintenance tasks (particularly identifying and clearing faults). These maintenance tools include the following:

- circuit card features that include card level tests and status indicators
- CPU controls that allow you to control common equipment functions
- system alarms that categorize the severity of a system failure
- system monitor indicators that identify power and temperature faults

Circuit card features

Battery backup for CPU memory

The NTND02 MSPS Card, used in option 21E, is equipped with the A0378252 Battery Pack Assembly. If power to the system is lost, the battery retains CPU memory for up to 60 minutes.

Card test

A card test checks to see that a card is working correctly. Many cards perform a self-test on power-up. You can also force card-level tests through software commands.

Enable/disable switch

Some cards have a switch on the faceplate that enables or disables the hardware for that card.

When you remove a card, whenever possible disable the software; then, disable the hardware by setting the switch to Dis.

Hardware disable a card (set the switch to Dis) before you install it. After the card is locked into position, set the switch to Enb; then enable the software. Software disable and enable cards as described in the *X11 input/output guide* (553-3001-400).

Figure 5 shows the typical location of an enable/disable (Enb/Dis) switch.

LED

Many cards have one or more light emitting diodes (LEDs) on the faceplate. The LED gives a visual indication of the status of the card or of a unit on a card.

When a *green* LED is steadily lit, it indicates the card is operating normally. When a green LED is off, it indicates the card is disabled or faulty.

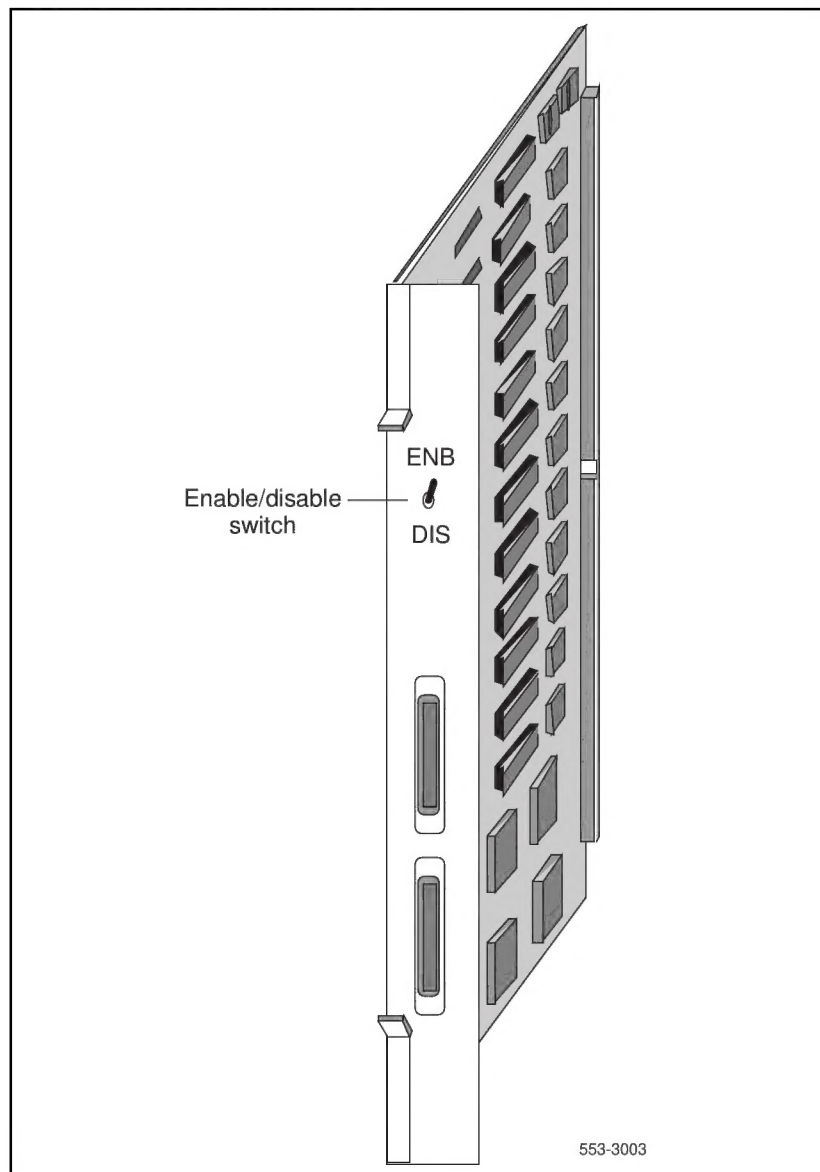
When a *red* LED is steadily lit, it indicates the card, or a unit on it, is disabled or faulty. When a red LED is off and power is available to the card, it indicates the card is operating normally.

Note 1: The shape of the LED (some are round and some are rectangular) does not indicate a different function.

Note 2: In options 51C, 61C, 81, and 81C, the red LEDs on the NT6D65 Core to Network Interface (CNI) Cards are lit when the associated Core is inactive. This is normal operation.

When intelligent peripheral cards are installed, the red LED on the faceplate remains lit for two to five seconds while a self-test runs. (The time required for the self-test depends on the type of card.) If the test is successful, the LED flashes three times and remains lit until the card's software is configured and enabled, and then the LED goes out. If the LED does not follow the pattern described or operates in any other manner (such as continually flashing or remaining weakly lit), the card should be replaced.

Figure 5
Sample enable/disable switch



In options 51C, 61C, 81, and 81C, when Core common control cards are installed, a self-test runs. If the self-test is successful, the LED flashes three times, then goes out.

Table 3 gives two examples of LED indications.

Table 3
Sample LED indications

Type of card	LED color	Status
Common equipment power supply	green	LED lit = operation normal
Digital line card	red	LED lit = disabled

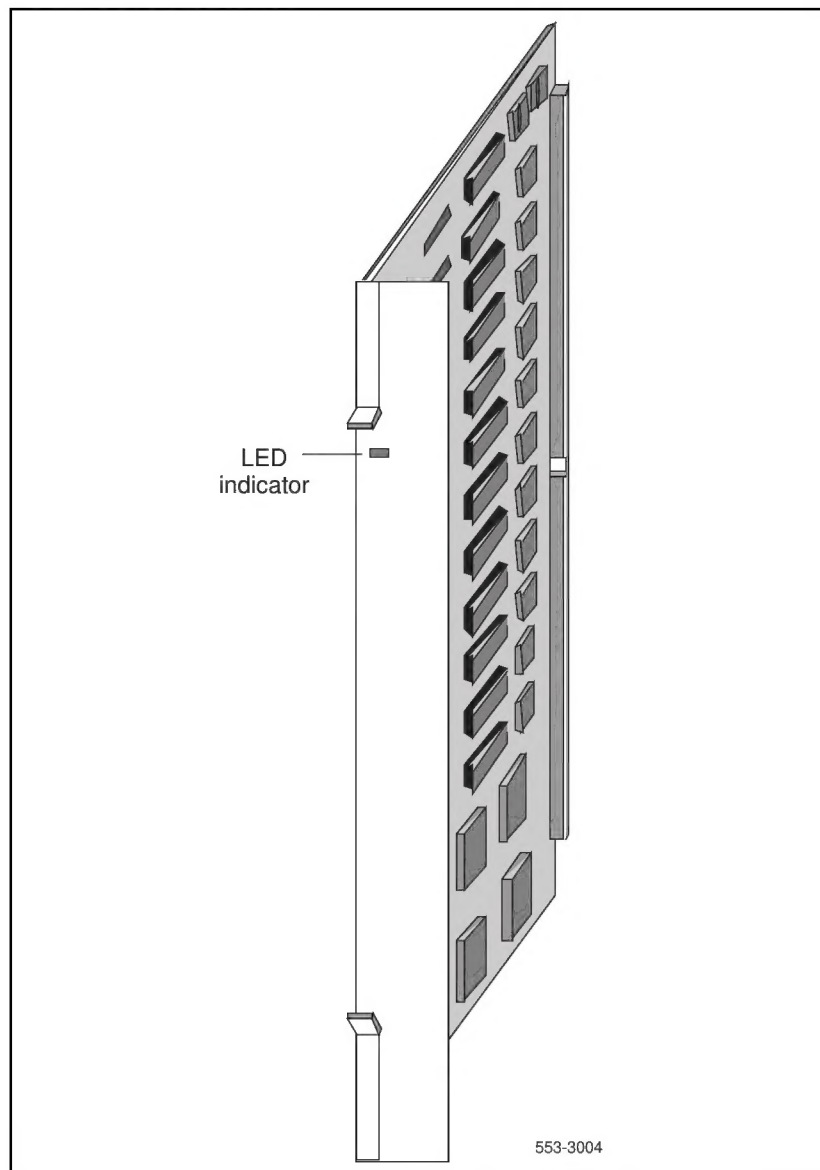
Figure 6 shows the location of the LED on the faceplate of an intelligent peripheral line card.

Maintenance display code

Maintenance displays are located on the faceplate of some circuit cards. A hexadecimal code is displayed. Interpretations of the maintenance display codes are listed under “HEX” in the *X11 system messages guide* (553-3001-411). You should examine previous codes, system messages, and visual indicators with any current maintenance display codes to properly analyze faults.

In options 51C, 61C, 81, and 81C, the maintenance display on the NT6D66 Call Processor Card or NT9D19 Call Processor Card shows two lines of information with up to 16 characters per line. The hexadecimal code and its definition are shown on the display.

Figure 6
Sample LED indicator



Each new code shown on a maintenance display overwrites the one before it. However, note the following:

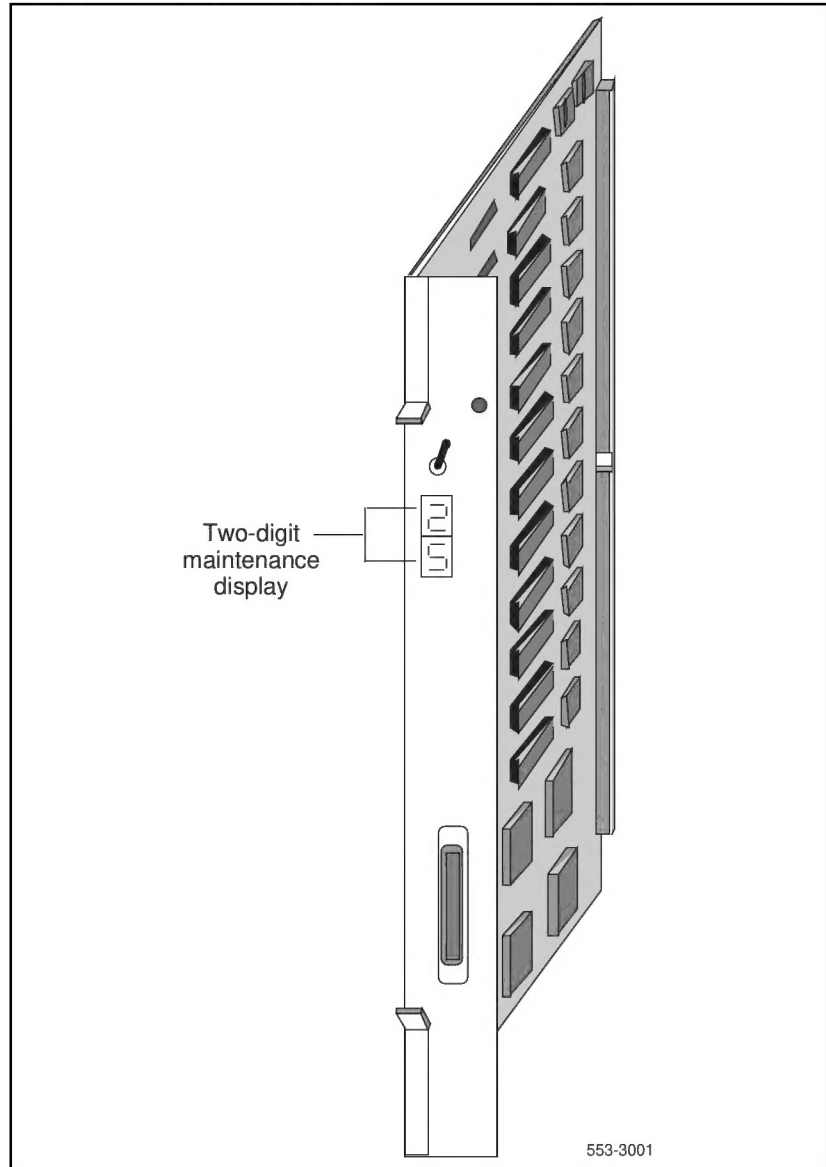
- All codes received on common equipment displays are recorded. You can review them by printing the History File.
- The most recent 16 codes displayed on a controller card stay in memory. You can review them and reset the counter through the Network and Signaling Diagnostic (LD 30).
- In options 51C, 61C, 81, and 81C, the most recent 64 displays on a CP card stay in memory. You can review the displays on the active CP card through the Core Common Equipment Diagnostic (LD 135).

Table 4 lists the cards with maintenance displays and the type of information the codes indicate on each card. Figure 7 shows the location of the maintenance display on the faceplate of a floppy disk interface card.

Table 4
Circuit cards with maintenance displays

System options	Circuit card	Display indication (for all related cards)
21A, 21	NT8D19 Memory/Peripheral Signaling Card	Sysload (system reload) status
21E	NTND01 ICM Card	Interrupt faults
51, 61, 71	QPC580 CPU Interface Card	Memory faults
51C, 61C, 81, 81C	NT6D66 Call Processor Card or NT9D19 Call Processor Card	Common equipment hardware faults
21A, 21, 21E, 51, 61	QPC742 Floppy Disk Interface Card	Faults on the disk drive unit
51, 61, 71	QPC584 Mass Storage Interface Card	Faults on the disk drive interface card
61C (NT9D11), 81	NT6D63 I/O Processor Card (X11 release 19 and 20)	
51C, 61C, 81, 81C	NT5D20 I/O Processor Card /Core Multi Disk Unit (IOP/CMDU) (X11 release 21 and higher)	
21, 21E, 51, 51C, 61, 61C, 71, 81, 81C	NT8D01 Controller Card NT1P62 Fibre Controller	During normal operation, display shows self-test codes and port number on which Controller Clock is tracking
21E, 51, 51C, 61, 61C, 71, 81, 81C, STE, RT, NT, XT	NT7R52 Remote Carrier Interface Card	During normal operation, display shows self-test codes and port number on which Controller Clock is tracking

Figure 7
Sample maintenance display



CPU controls

Switches and buttons on common equipment cards allow you to control CPU activity and clear common equipment faults.

Initialize button

Pressing the manual initialize (Man Int) button associated with the active CPU starts the Initialize Program. The Initialize Program clears common equipment faults and then rebuilds call-dependent data and generates system messages indicating the status of the system. This process is called an *initialization*. Call processing is briefly interrupted during an initialization.

Manual initialize buttons are located on the following cards:

- In options 21A and 21, the initialize button is on the NT8D19 Memory/Peripheral Signaling Card.
- In option 21E, the initialize button is on the NTND01 ICM Card.
- In options 51, 61, and 71, the initialize button is on the QPC580 CPU Interface Card.
- In options 51C, 61C, 81, and 81C, the initialize button is on the NT6D66 Call Processor Card or the NT9D19 Call Processor Card.

Normal/maintenance switch

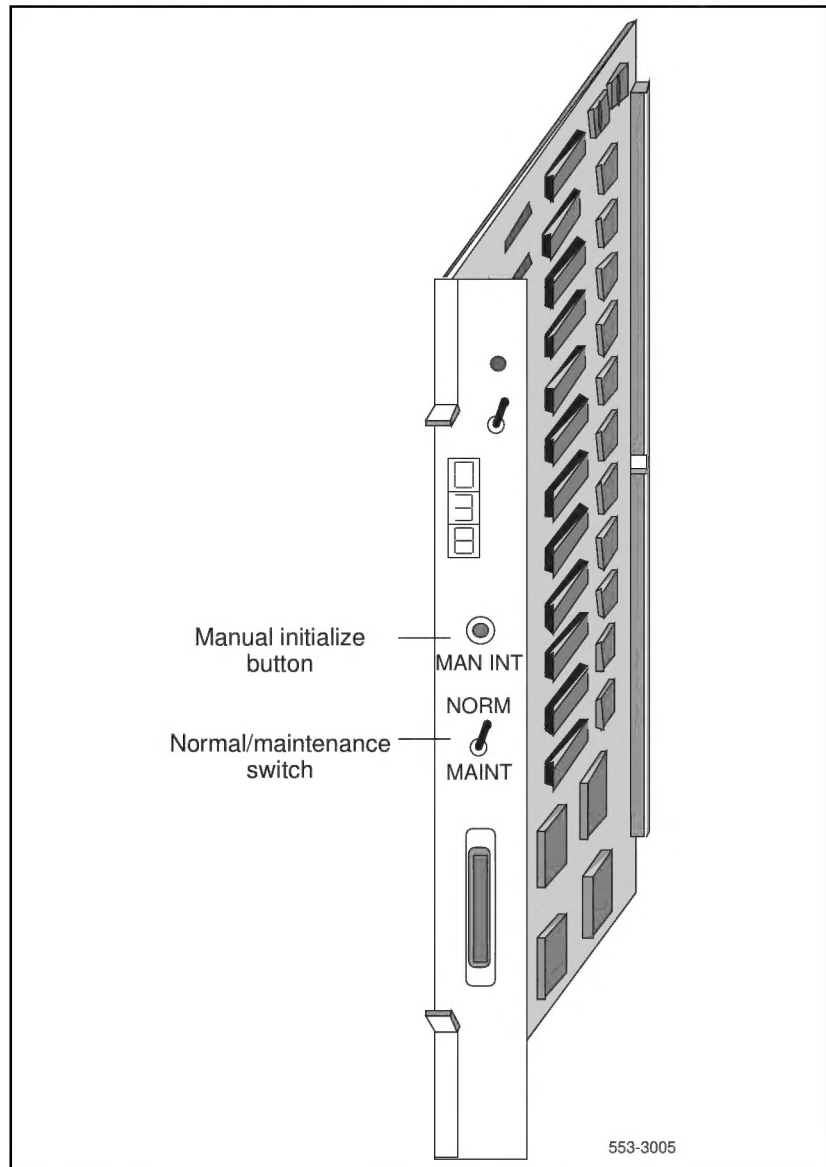
There is a normal/maintenance (Norm/Maint) switch on the QPC580 CPU Interface Card and the NT6D66 CP Card or NT9D19 CP Card. In dual CPU systems (options 61, 61C, 71, 81, and 81C), you use this switch as follows to keep the dual CPUs from switching, or trying to switch, when you are testing or replacing common equipment hardware on the inactive CPU:

- On the CPU you are not testing or replacing, set the switch to Maint. This CPU will be *active*.
- On the CPU you are testing or replacing, set the switch to Norm. This CPU will remain *inactive* as long as the other CPU is set to Maint.

For regular operation in dual CPU systems, set both normal/maintenance switches to Norm. For option 51 and 51C (a single CPU system), set the switch to Maint.

Figure 8 shows the location of both the manual initialize button and the normal/maintenance switch on the QPC580 CPU Interface Card.

Figure 8
Manual initialize button and normal/maintenance switch
on the CPU interface card



Reload button

Reload (Rld or Man Rst) buttons allow you to manually activate the System Loader program. The System Loader initiates call processing and starts memory-checking diagnostics. This process is called a *sysload* or *system reload*. Here are the locations of the reload button for the various options:

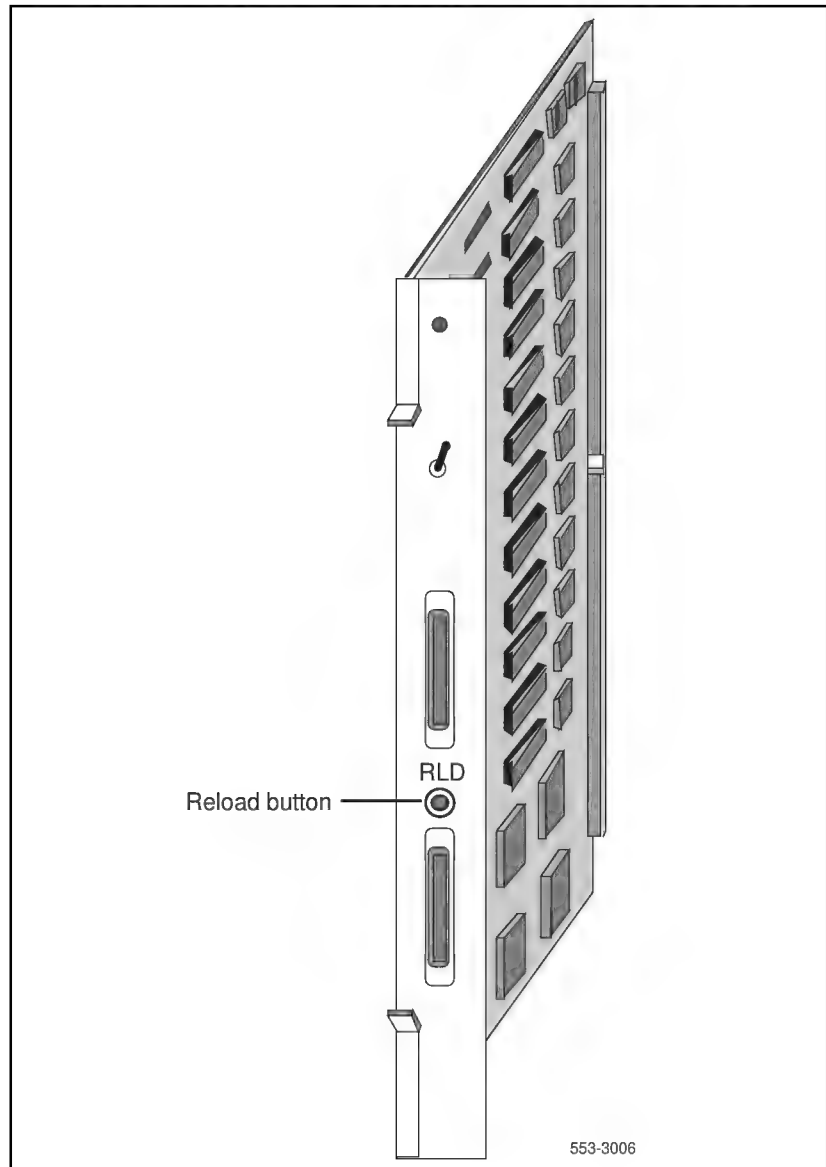
- In options 21A and 21, the reload button is on the QPC687 CPU Card.
- In option 21E, the reload button is on the NTND01 ICM Card.
- In option 51, the reload button is on the NTND10 Changeover and Memory Arbitrator (CMA) Card (or QPC581 before X11 release 18).
- In options 61 and 71, the reload button is on the NTND10 (or QPC581) CMA Card. To start a sysload, you must simultaneously press the reload button on both CMA cards.
- In options 51C, 61C, 81, and 81C, the reload button (Man Rst) is on the NT6D66 CP Card or the NT9D19 CP Card. To start a sysload, you must simultaneously press the reload buttons on both CP cards.

Figure 9 shows the location of the reload button on a QPC581 CMA Card.

CAUTION

During a sysload active calls are disconnected and the system goes into an emergency line transfer state. Use the reload button only if you are specifically instructed to do so in Northern Telecom Publications.

Figure 9
Reload button on the changeover and memory arbitrator card



System alarms

System alarms are based on various fault monitors and indicators. The category of the alarm—major, minor, or remote—indicates the severity of the system failure:

- A major alarm requires immediate action by the technician.
- A minor alarm requires attention, but not necessarily immediate attention, by the technician.
- A remote alarm may require attention by the technician.

Major alarms

A major alarm indicates a fault that seriously interferes with call processing. The following faults cause a major alarm:

- CPU or control bus failure
- disk system failure when attempting to load the system
- system power failure (without reserve power)
- temperature fault (excessive heat)

When there is a major alarm, the red LED at the top of the affected column lights. A major alarm also activates a display on all attendant consoles.

When a Meridian 1 is equipped with a power failure transfer unit, a major alarm causes designated 500/2500 telephones to connect directly to Central Office trunks; this is called a line transfer.

Minor alarms

A minor alarm indicates the system hardware or software has detected a fault requiring attention. The following faults cause a minor alarm: Automatic identification of outward dial (AIOD) trunk failure

- conference failure
- digitone receiver failure
- memory failure
- more than one fault on different line and trunk cards in one shelf (indicated on affected customer's console only)
- network failure (indicated on affected customer's console only)
- peripheral signaling failure
- serial data interface failure
- tone and digit switch failure

A minor alarm displays an alarm on attendant consoles in customer groups affected by the fault. (A minor alarm indication on the console is an optional feature, enabled and disabled on a customer basis through data administration procedures.)

Remote alarms

A remote alarm is an optional extension of a major alarm to another location, such as a monitoring or test center, or to an indicator, such as a light or bell. When a major alarm occurs, the Meridian 1 provides relay contact closure across two remote alarm lines, REMALMA and REMALMB. These lines are extended to the main distribution frame (MDF) through the system monitor to MDF cable for customer use. The relay contacts are rated at 30 V dc and 2 amps. The REMALMB line is the return or ground for the REMALMA line. Northern Telecom does not extend remote alarm lines beyond the MDF.

System monitor indicators

The system monitor checks the column temperature, cooling system status, and system voltage status and controls line transfer states accordingly.

NT7D15 System Monitor

System option 21A is equipped with the NT7D15 System Monitor, which is a paddle board installed on the rear of the backplane. This system monitor performs the following:

- If the main circuit breaker in the system trips (for example, if there is a power surge or short circuit), the system monitor starts a line transfer and sends a remote alarm signal.
- If the temperature of the column reaches 70 degrees C (158 degrees F), the system monitor trips the main circuit breaker, starts a line transfer, and sends a remote alarm signal.
- If the power supply loses +5 volts, the system monitor starts a line transfer and sends a remote alarm signal.
- If the power supply loses any voltage other than +5 volts, the system monitor lights the column LED, sends a major alarm indication to the CPU, and sends a remote alarm signal.
- If call processing stops, the system monitor lights the column LED and starts a line transfer.

Note: The NT7D15 System Monitor does not generate system messages.

When major system failures occur, the system monitor sends a remote alarm signal. As an option, an indicator, such as a bell or light, can be connected to the system monitor to receive the remote alarm signal.

NT8D22 System Monitor

System options 21, 21E, 51, 51C, 61, 61C, 71, 81, and 81C are equipped with the NT8D22 System Monitor, which is installed in the rear of the pedestal in each column. Table 5 lists faults monitored by this system monitor.

Note: The NT8D15 System Monitor must be used in option 21A. In multiple-column systems, there is one master system monitor, located in the column with CPU 0, and multiple slave system monitors. A switch setting on each system monitor defines the master or the address of each slave.

Table 5
Faults monitored by the NT8D22 System Monitor

Power faults	Source
CPU condition	CPU failure Sysload (system reload)
Main power loss	System input power, AC or DC
Power supply failure	Common equipment power supply Common/peripheral equipment power supply Peripheral equipment power supply Ringing generator
Temperature alarm	Blower unit Column temperature sensors

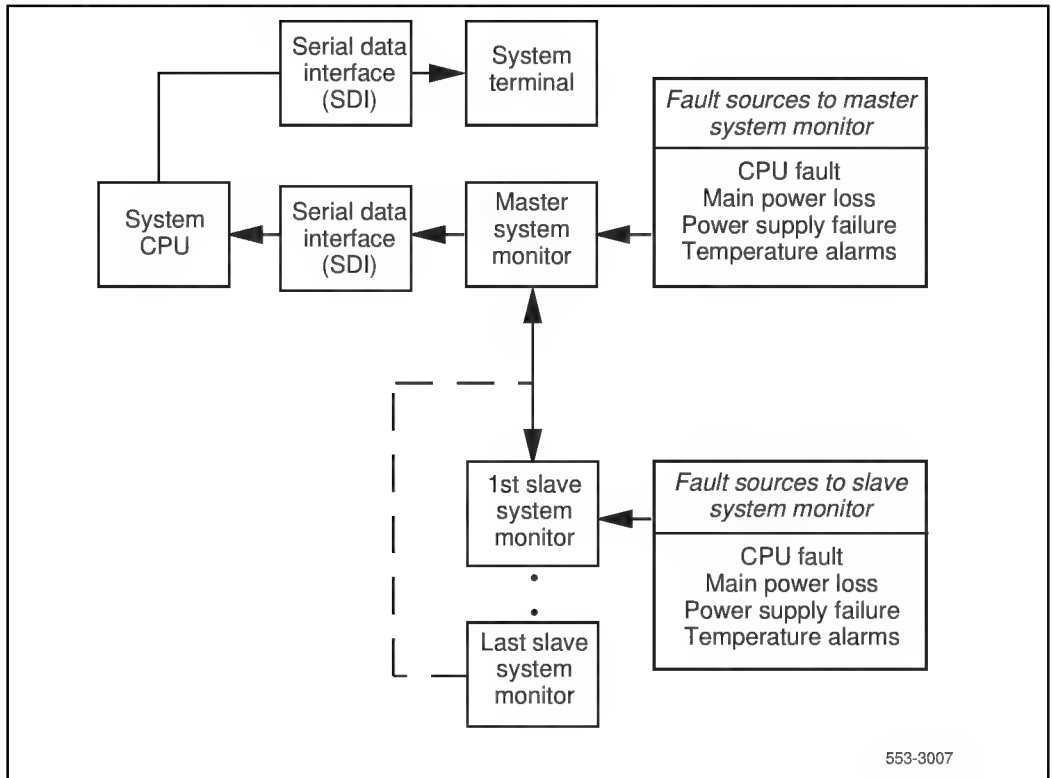
The master system monitor checks the CPU column and periodically polls the slaves to check their status. When polled, the slaves report their status to the master. If a slave does not respond when it is polled, the master reports the address as a faulty slave.

If a slave is removed, the master cannot communicate with higher addresses. Therefore, the master considers the removed slave and all slaves with a higher address as disabled. For example, if slave 2 is disabled, the master also reports slaves 3, 4, and up as disabled.

The system monitor reports power equipment status and faults to the CPU. (Only the master system monitor communicates with the CPU.) System messages generated by the system monitor are identified by the mnemonic PWR. Figure 10 shows the flow of messages from NT8D22 System Monitors to the system terminal.

If there is a fault, the system monitor lights the LED on the affected column.

Figure 10
NT8D22 System Monitor message flow



Line transfer

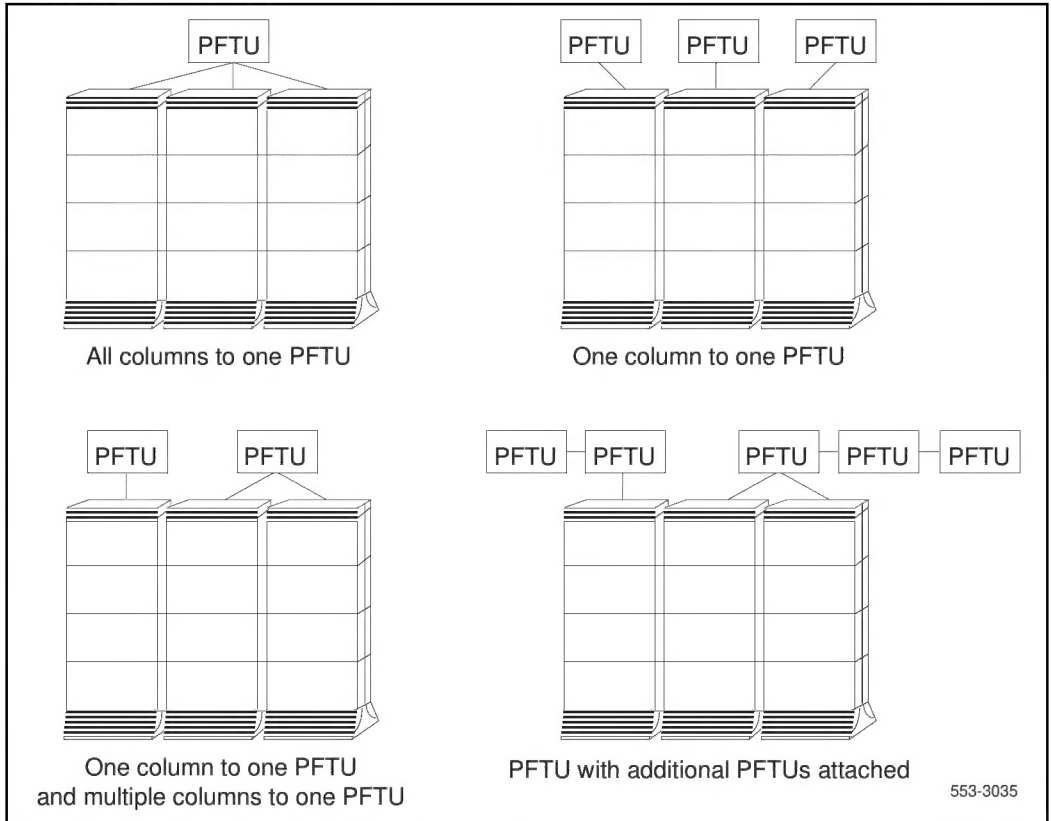
As an option, you can connect one or more power failure transfer units (PFTUs) to the Meridian 1. Each PFTU connects up to eight designated 500/2500 telephones to Central Office trunks. If call processing stops, those 500/2500 telephones are transferred through the PFTU to the Central Office so that you still have outside connections. A line transfer occurs during the following situations:

- during a sysload (system reload)
- if there is a major power failure in a DC-powered system (as detected by the TRIP signal)
- if call processing stops because of a CPU failure
- if there is a loss of power to the column
- if there is a loss of power to the PFTU
- if the temperature in a column is too high
- if a line transfer button on the attendant console is pressed (this applies on a customer basis)
- if a line transfer switch on the PFTU is turned on

Note: If position 4 on switch 1 (SW1) is set to OFF on a system monitor, that system monitor's column will not activate a line transfer if the temperature is too high.

Figure 11 shows four ways multiple-column systems and PFTUs can be configured. You can configure in the following ways:

- connect all the columns in a system to a single PFTU
- connect each column to an individual PFTU
- combine connecting individual columns to individual PFTUs and multiple columns to a single PFTU
- attach additional PFTUs to a PFTU that is connected to one or multiple columns

Figure 11
PFTU configurations

Main power loss

The system monitor receives status and control signals from the external power system. The system monitor then generates system messages that indicate the status of main and reserve power supplies.

You can connect a reserve (back-up) power supply to the Meridian 1: either an uninterruptible power supply (UPS) for AC-powered systems or reserve batteries for DC-powered systems. If the main source of external power is lost, power to the system is maintained by the UPS or reserve batteries.

If the main power supply is lost, the system monitor generates a major alarm. The NT8D22 System Monitor also generates system messages to indicate the system is running on reserve power.

Module power supply failure

There are four types of module power supplies:

- common equipment (CE) power supply
- common/peripheral equipment (CE/PE) power supply
- peripheral equipment (PE) power supply
- ringing generator

The NT8D22 System Monitor handles complete or partial failures in a module power supply as follows:

- If the output voltage is higher than the threshold for +5 volts, the affected power supply shuts down, the column LED lights, and a system message is sent.
- If the output voltage is higher than the threshold for other than +5 volts, power for only that voltage shuts down in the affected power supply, the column LED lights, and a system message is sent.
- If the output voltage is lower than the threshold for any voltage, power for only that voltage shuts down in the affected power supply, the column LED lights, and a system message is sent.
- If the input voltage is lower than the threshold, the affected power supply shuts down and then recovers when the input level recovers.

To help you pinpoint a power supply problem, the master NT8D22 System Monitor identifies the following:

- the column with the fault (system monitor 0–63)
- the module (0–3) in that column
- the power supply unit (1–2) in the module

Figure 12 shows the power equipment designations in a column.

Temperature alarms

System option 21A has two fans in the top cap. If the temperature of the system exceeds 70 degrees C (158 degrees F), the NT7D15 System Monitor trips the main circuit breaker to prevent further overheating.

Each column in options 21, 21E, 51, 51C, 61, 61C, 71, 81, and 81C is cooled by a blower unit (NT8D52AB with AC power or NT8D52DD with DC power) in the pedestal. All of these systems are equipped with the NT8D22 System Monitor, which performs the following functions:

- If there is a partial or complete failure in a blower unit, the system monitor lights the column LED and generates a system message.
- If the thermostats in a column report a temperature exceeding 70 degrees C (158 degrees F), the system monitor lights the column LED, generates a system message, then, providing this condition exists for 30 seconds, shuts down power to the column in 30 seconds.

The NT8D22 System Monitor generates a system message if the air leaving the column exceeds 55 degrees C (131 degrees F). This thermal alarm may indicate a loss of air-conditioning in the room, loss of ventilation in the column, a problem with the blower unit, or a blocked air filter.

Figure 12
Power equipment designations from the master NT8D22 System Monitor

